

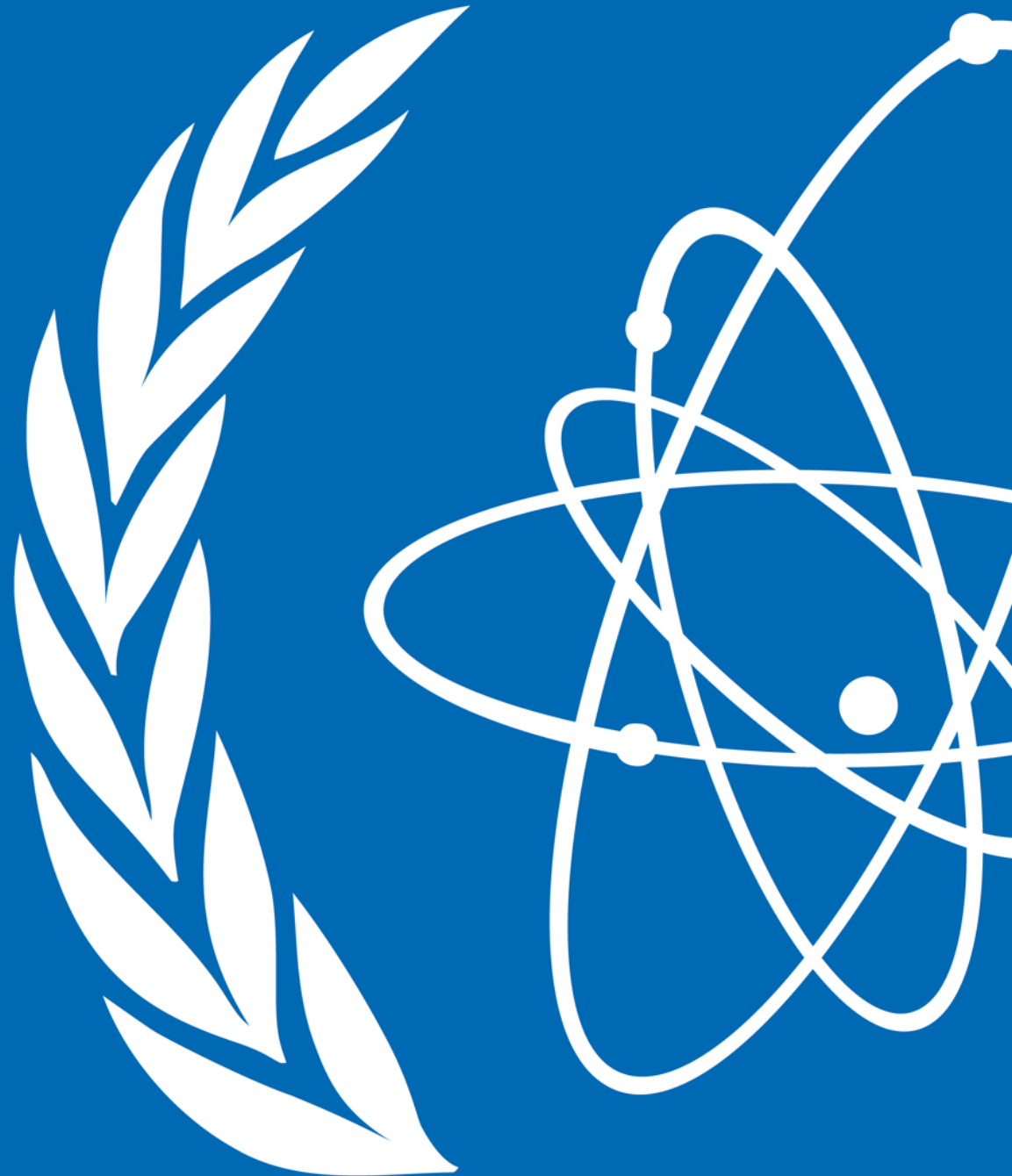
INPRO Activities in Innovative Fast Reactor Technologies

Carolynn Scherer, INPRO Section Head

TM Advances and Innovations in Fast
Reactor Design and Technology

2 Oct 2025

Vienna, Austria



Content

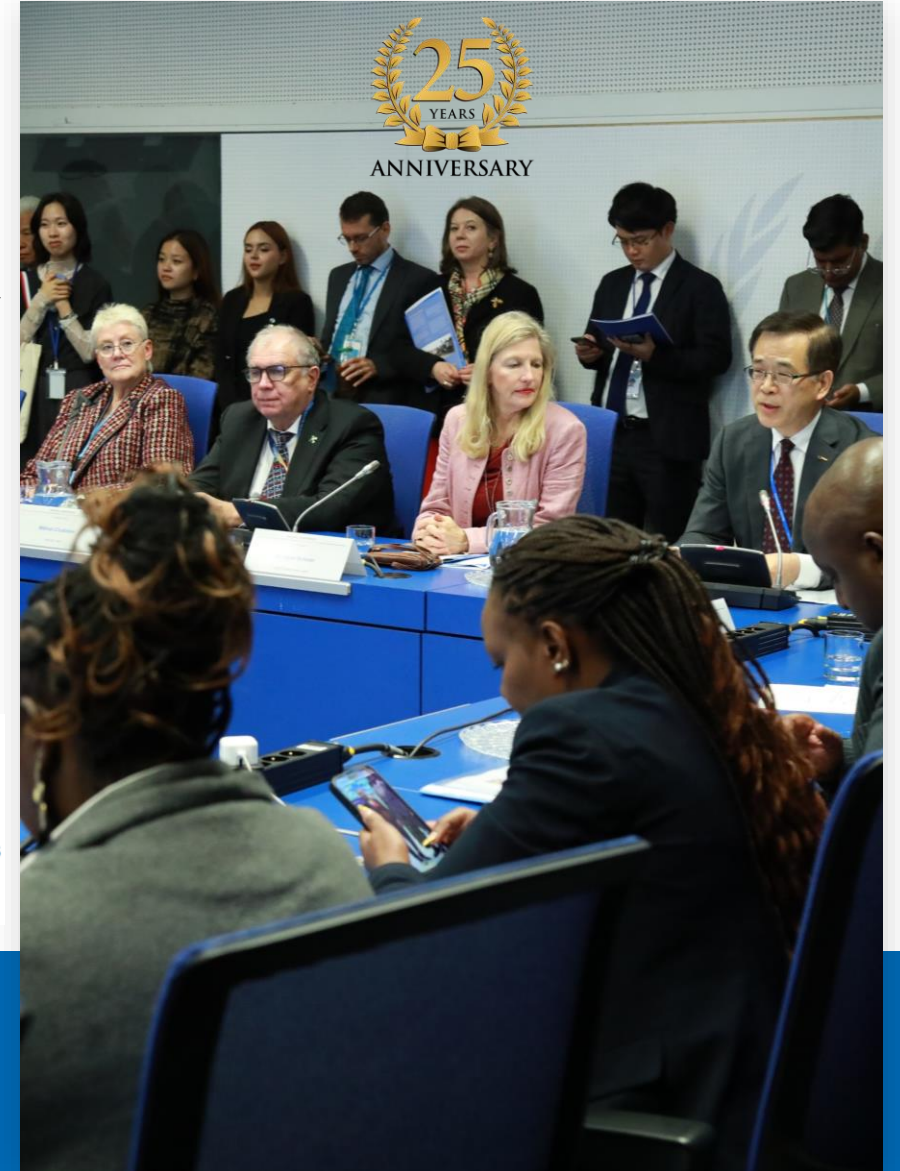
- What is INPRO
- INPRO Concept of Sustainable Nuclear Energy Planning
- INPRO Activities in Fast Reactors
- Support to Member States



INPRO

International Project on
Innovative Nuclear Reactors
and Fuel Cycles

Ensure that *nuclear energy is available* to
contribute to *sustainably* fulfilling, energy needs in
the *21st century & beyond*

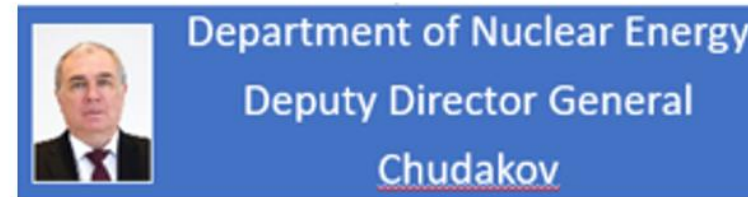
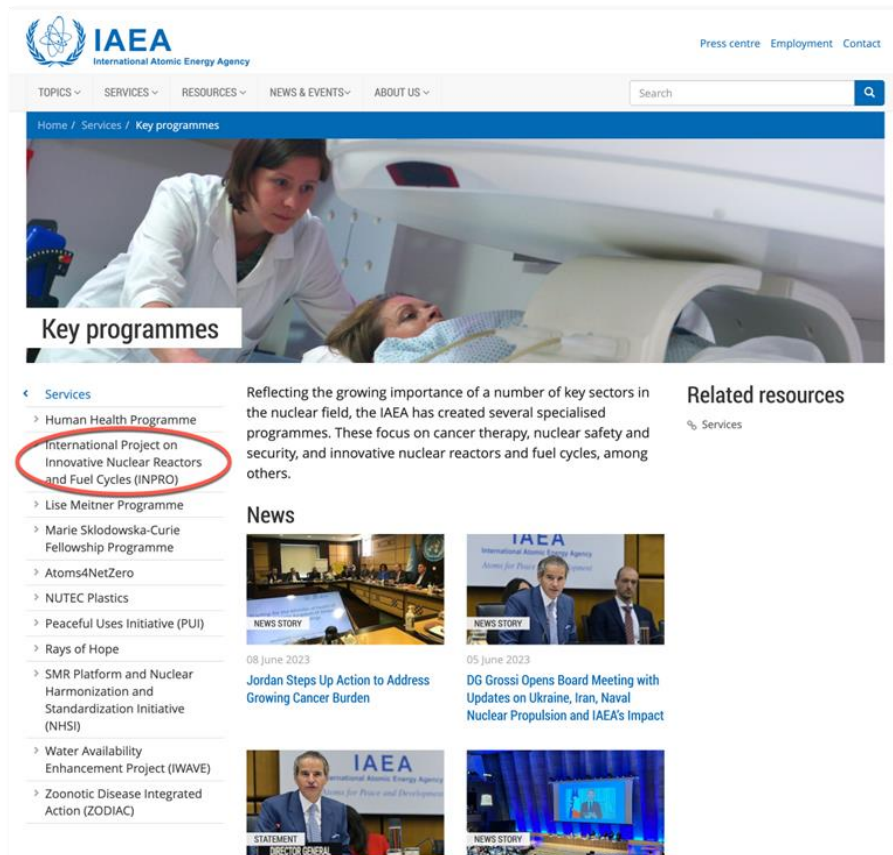


INPRO 25th Anniversary at IAEA General
Conference, 16 Sep 2025

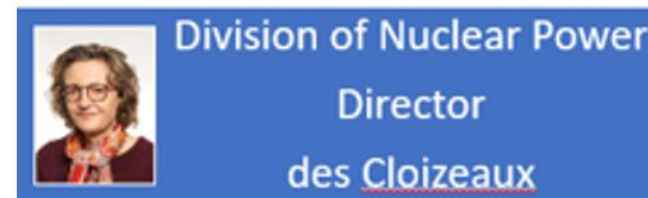
International Project on Innovative Nuclear Reactors and Fuel Cycles - INPRO

INPRO Section in IAEA Structure

Key IAEA Programme

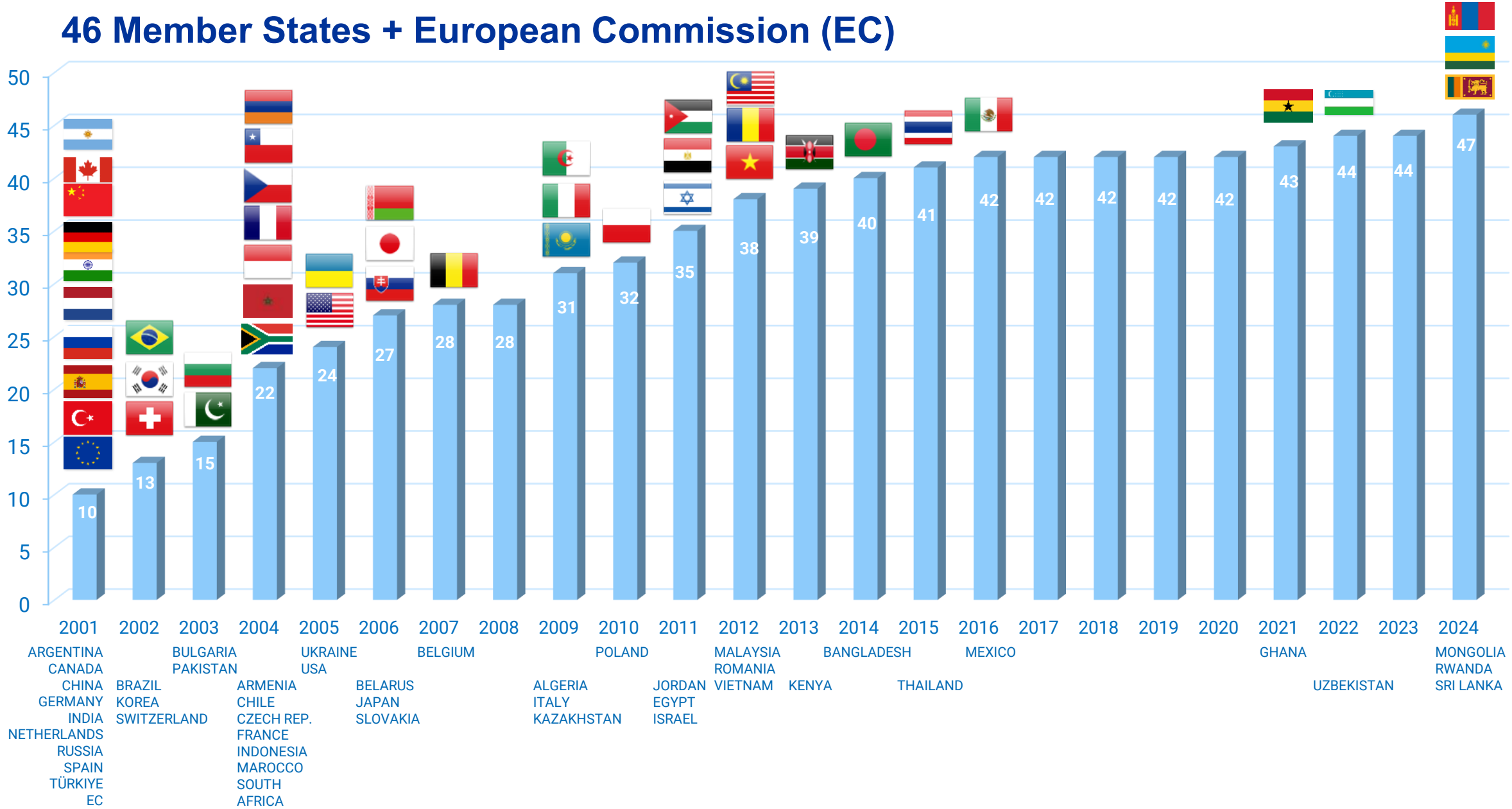


Program Manager:
DDG-NE



INPRO Members

46 Member States + European Commission (EC)



Beginning of INPRO



History

- Initiated by IAEA General Conference Resolution in September 2000
- Launched in May 2001
- Agency-wide project run by **Steering Committee**
- Implemented mostly using extra-budgetary funds

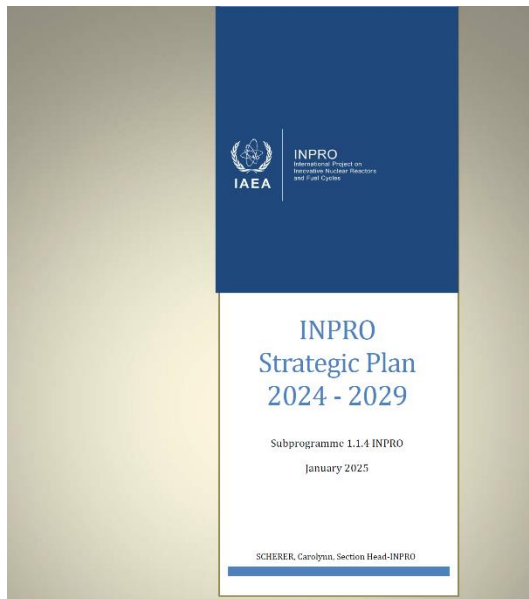
GC(44)/RES/21 and 22

Invited all interested member states to:

- *Combine their efforts under the aegis of the Agency in considering the issues of the nuclear fuel cycle, in particular by examining innovative and proliferation resistant nuclear technology*
- *Contribute to a task force on innovative nuclear reactors and fuel cycles*

INPRO Steering Committee

- Meets annually to review progress
- Provides guidance on INPRO activities and projects
- Endorses INPRO Strategic Plan
 - 6-year strategic plan
 - Aligns: IAEA Medium Term Strategy 2024-2029
- Endorses INPRO Subprogramme Plan
 - Defines project areas and tasks
- Supports INPRO through extrabudgetary funds



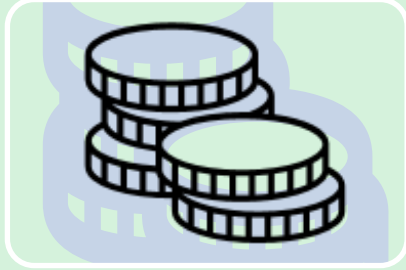
INPRO 33rd Steering Committee Meeting
(SCM-33) 29-30 Oct 2024

Objectives from Terms of Reference (ToR)

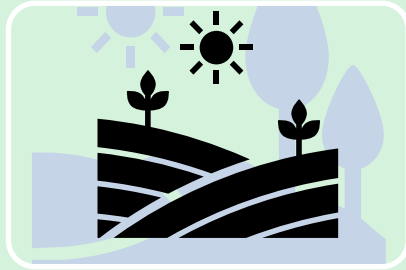
- Ensure that ***nuclear energy is available*** to contribute in fulfilling, ***in a sustainable manner***, energy needs in the ***21st century***
- Bring together all interested Member States, technology holders and technology users, to **consider jointly the international and national actions** required to achieve desired innovations in nuclear reactors and fuel cycles that are economically competitive, inherently safe, minimize risk of proliferation and environmentally minimal impact
- Create a process that **involves all relevant stake holders** that will have an impact on, draw from, and complement both the activities of existing institutions and ongoing initiatives at national and international levels



UN Concept of Sustainable Energy Development



Economical



Environmental



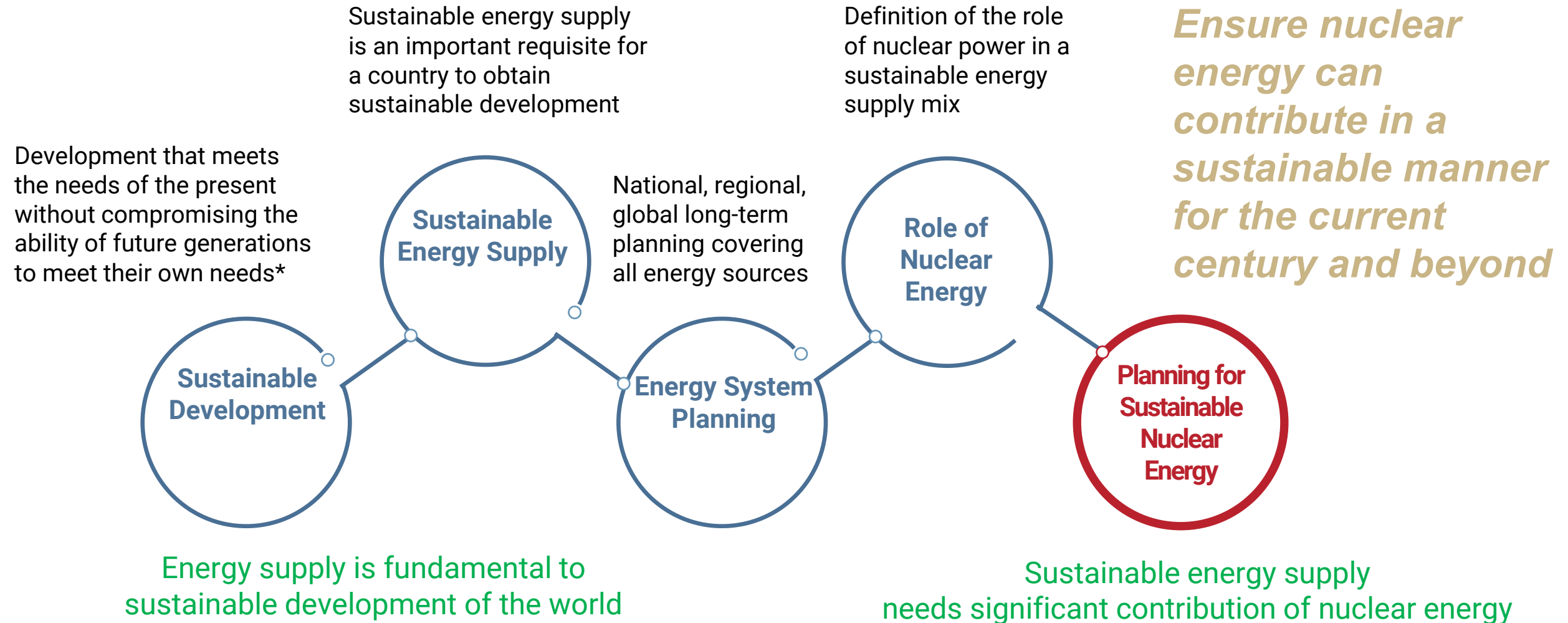
Societal



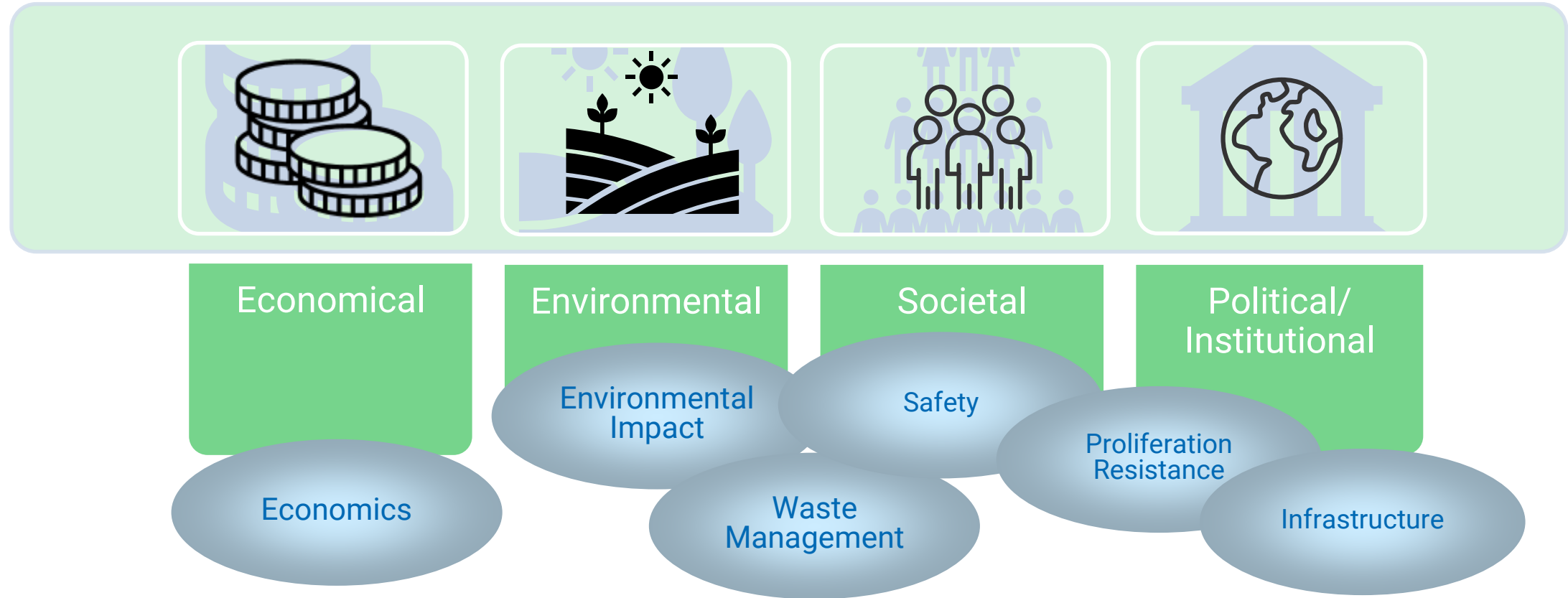
Political/
Institutional

Development that meets the needs of the present without
compromising the ability of future generations
to meet their own needs

Sustainable Energy Planning



INPRO Methodology for Sustainable Nuclear Energy



Built upon UN concept of sustainable development
Built a standardized methodology

INPRO Methodology Key Areas

Ensure NE remains economically viable and competitive

Economics



Limiting environmental effects and ensure long-term resource availability

Environmental Impact



Consciously protecting current and future generations

Waste Management



Unattractive to a proliferator

Proliferation Resistance



Prevent/minimize mishaps

Safety



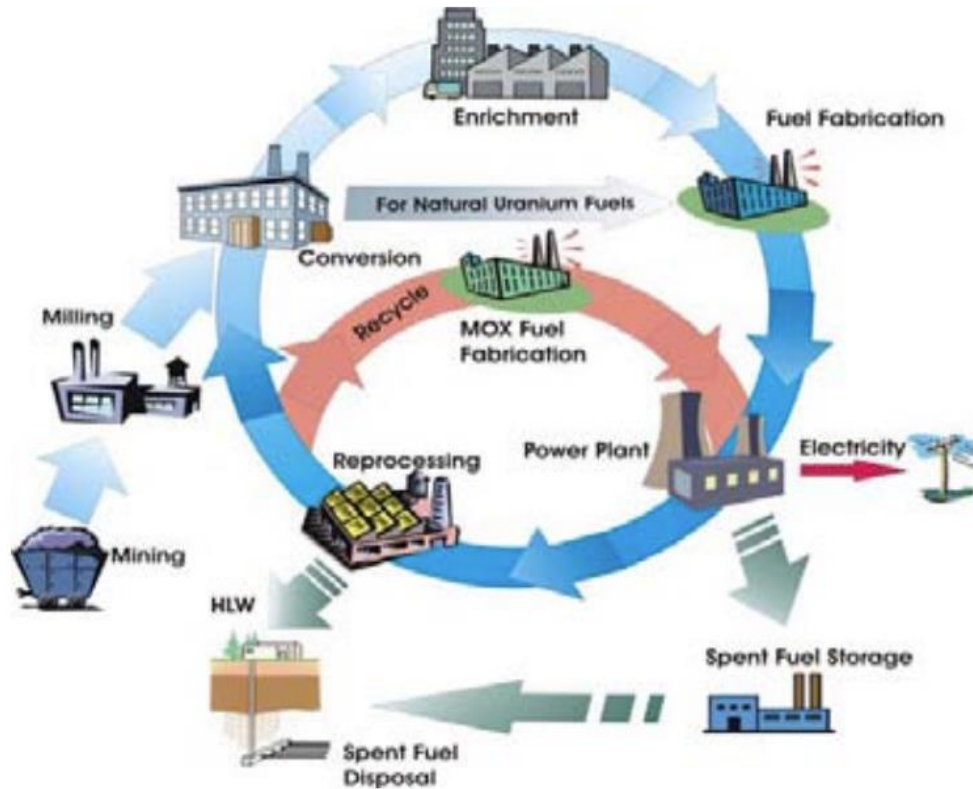
Robust legal, regulatory, and institutional frameworks to support

Infrastructure



Sustainable nuclear energy planning

*Nuclear energy
can contribute
in a sustainable
manner for a
century and
beyond*



INPRO Methodology

- Initial focus on nuclear reactor facilities
- Innovative and evolutionary
- Holistic
- Lifecycle
- Making decisions on innovative nuclear energy systems
- Supports future generations in meeting their needs

2025

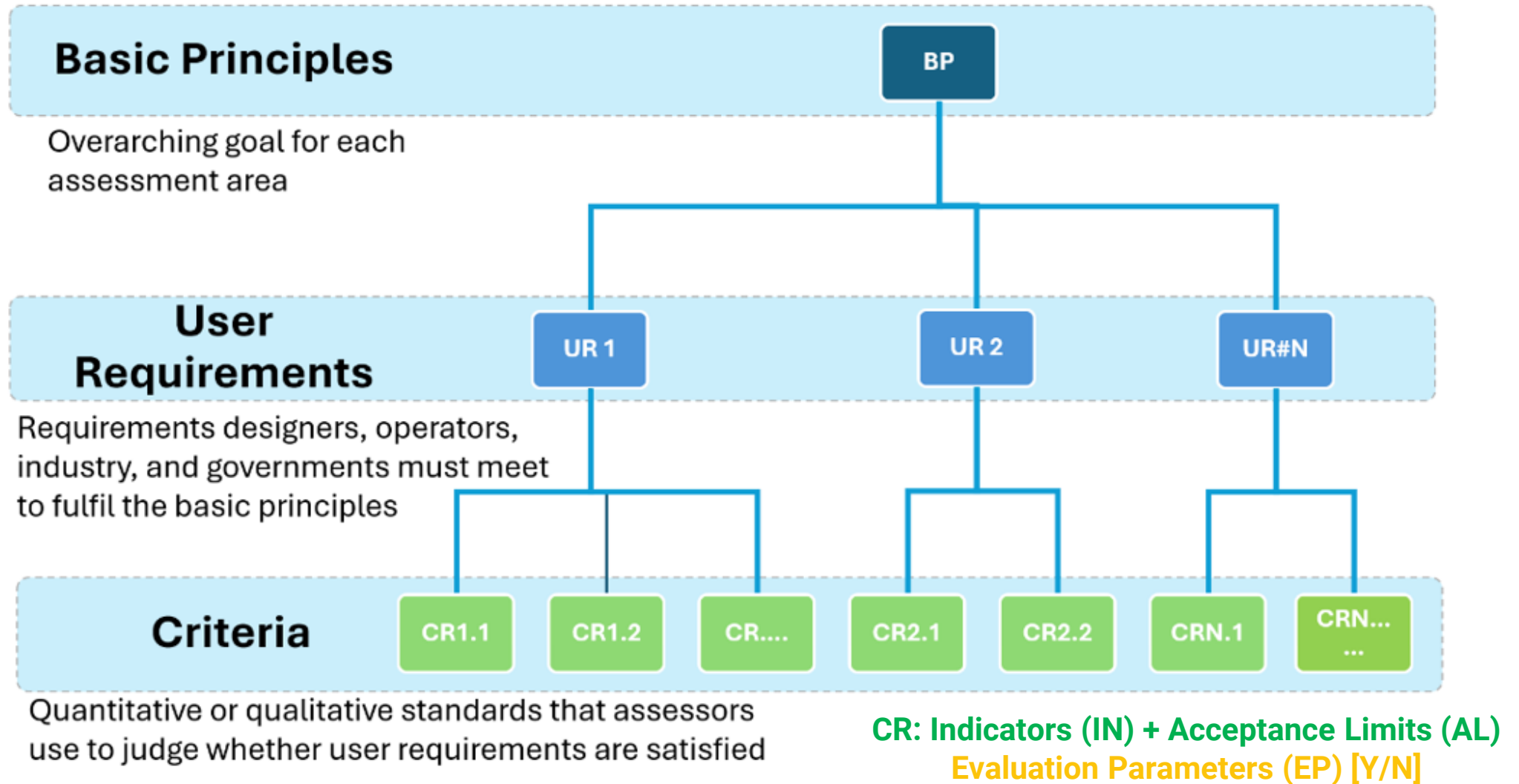
2050

2075

2100

2125

INPRO Methodology Framework



NESA Innovative - Sustainability

Progressive

- **Toward improved metric**
- Reduces uncertainty
- Identify R&D needs

Comparative

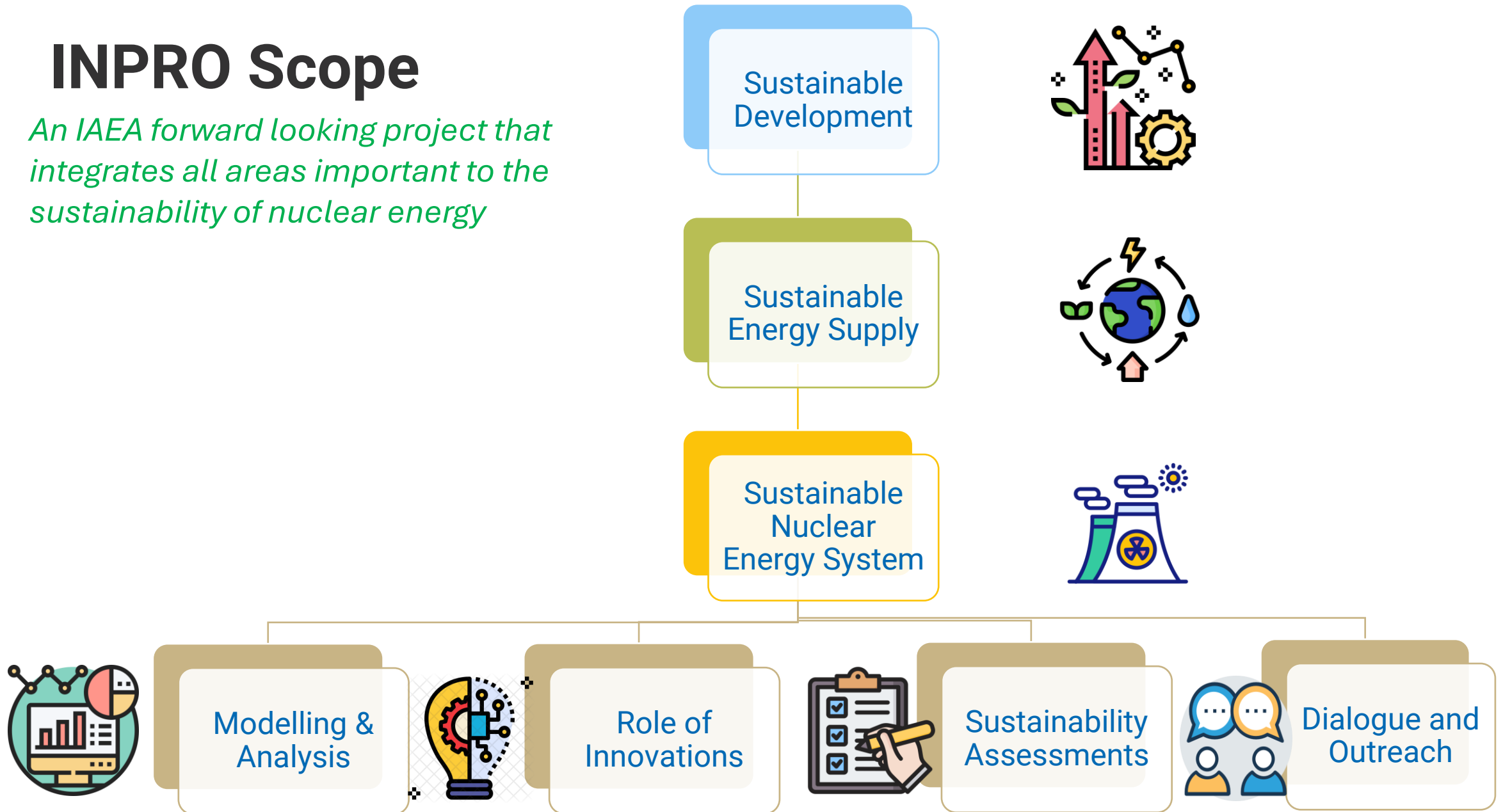
- Performance on a **metric for 2 options**

Innovative

- **Forward-looking target value for a metric**
- Less impact on environment, better economics, etc.
- Identification of R&D needs

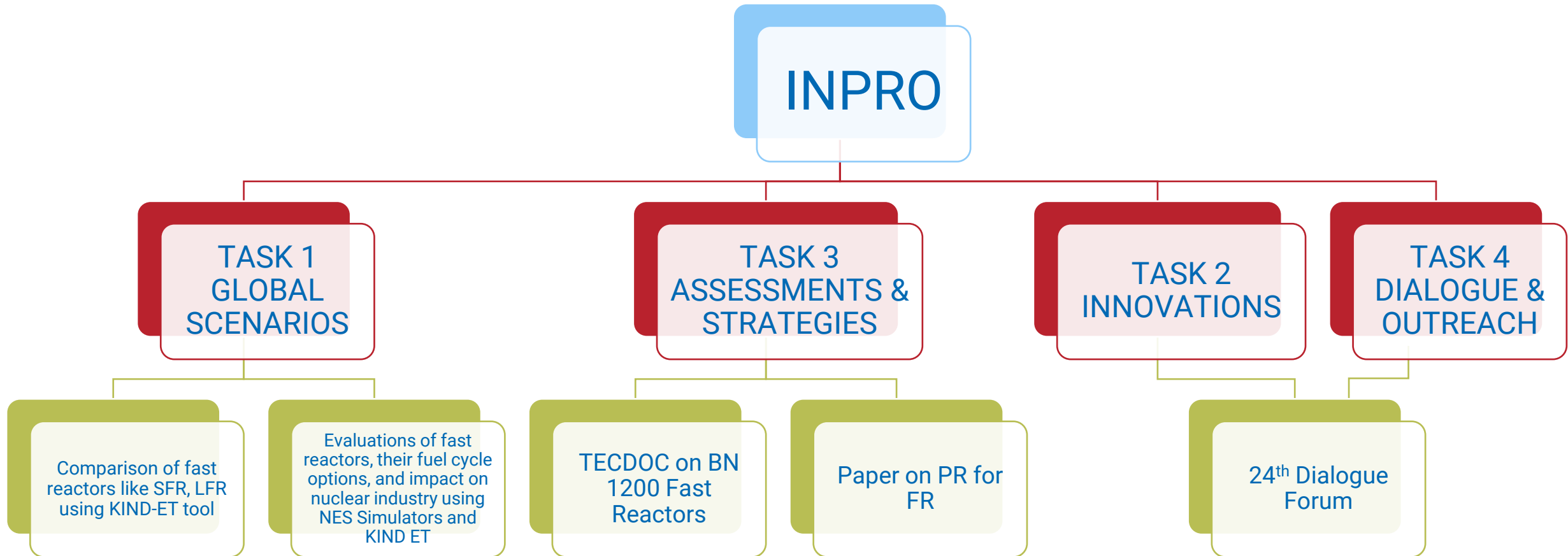
INPRO Scope

An IAEA forward looking project that integrates all areas important to the sustainability of nuclear energy



INPRO addresses all dimensions of sustainability concept

Fast Reactor activities in INPRO Task areas

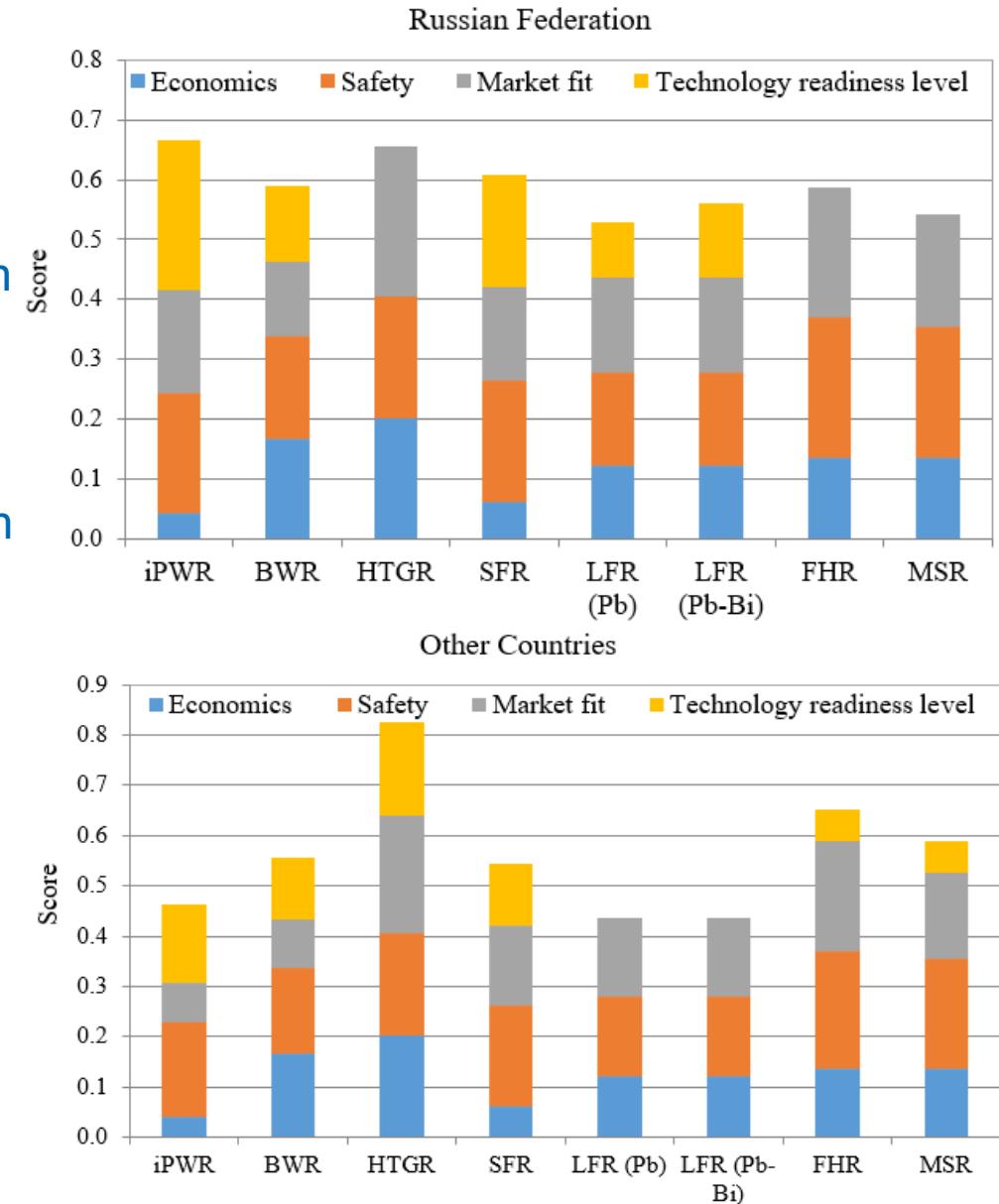


ASENES SMR – Case study by Russian Federation

Objective: Compare different reactor technologies in application to SMRs

Results:

- Integral PWR is preferred in Russia; HTGR for countries other than Russia
- TRL should not be considered strictly as a criterion but rather being a factor affecting customer's choice



STEP FORWARD

The STEP FORWARD collaborative project applies the INPRO methods and tools, along with national tools of relevance to evaluate NES scenarios operating light water reactors (LWRs) and evolutionary reactors with a thermal neutron spectrum and deploying innovative nuclear installations to support multi-recycling of spent fuel.

- ✓ **TM: 6-10 Oct 2025, Indonesia**
- ✓ MS: France, Ghana, Indonesia, Kenya, Rep. of Korea, Pakistan, Russian Fed., Thailand, Türkiye, Ukraine, USA

Several scenarios with fast reactors and associated fuel cycles



IAEA TECDOC SERIES

Analysis Support for
Enhanced Nuclear
Energy Sustainability
Pilot Study “Potential
of Innovative Nuclear
Installations to Support
Multi-Recycling of Fuel
in a Nuclear Energy
System “STEP
FORWARD”



2026

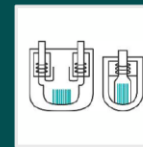
Task 2 – 24th Dialogue Forum



On the Licensing Framework of Floating Nuclear Power Plants

Giulio Gennaro, Executive Director Offshore Industrial Applications
24th INPRO, Wien, 20 May 2025

A new, innovative player in nuclear energy



REACTOR DESIGN:
Small Modular (SMR) + Lead-cooled Fast Reactors (LFR) = AMR
newcleo is working to design, build, and operate Gen-IV Advanced Modular Reactors (AMRs) cooled by liquid lead



FUEL MANUFACTURING:
Mixed Uranium Plutonium Oxide (MOX)
MOX and Fast Reactors allow the multi-recycling of nuclear waste into new fuel with no new mining for generations

INTRINSICALLY SAFE
power production

COMPETITIVE
energy cost

CIRCULAR
nuclear waste recycling

newcleo
Futurable Energy



Launched in SEPTEMBER 2021

Presence across EUROPE

- €537 million of private funds ~€60 million turnover in 2024
- French first licensing stage completed for the first reactor and the fuel production facility
- Selected by France 2030 and the European Industrial Alliance on SMRs

1,100+ EMPLOYEES GLOBALLY

30+ YEARS OF R&D

22 PATENTS

Highly specialised EPCM capabilities

FUCINA ITALIA A member company of newcleo

S.R.S. A member company of newcleo

RÜTSCHI A member company of newcleo

ISO9001 and ISO19443 certification



Task 3: INPRO Application to FR

China: CEFR

- Safety
- Economics
- Date published: 2021

On BN1200 Fast Reactors

IAEA TECDOC SERIES

IAEA-TECDOC-1959

Limited Scope Sustainability
Assessment of Planned
Nuclear Energy Systems
Based on BN-1200 Fast Reactors

Applying INPRO Methodology in PR to FR

- August 2025
- Paper with IAEA and authors from GIF PR & PP WG

INPRO Methodology for Proliferation Resistance of Fast Reactors and Fuel Cycles

INPRO the International Project on Innovative Nuclear Reactors and Fuel Cycles

Divya Bojja, INPRO Intern

Carolynn Scherer | Section Head INPRO

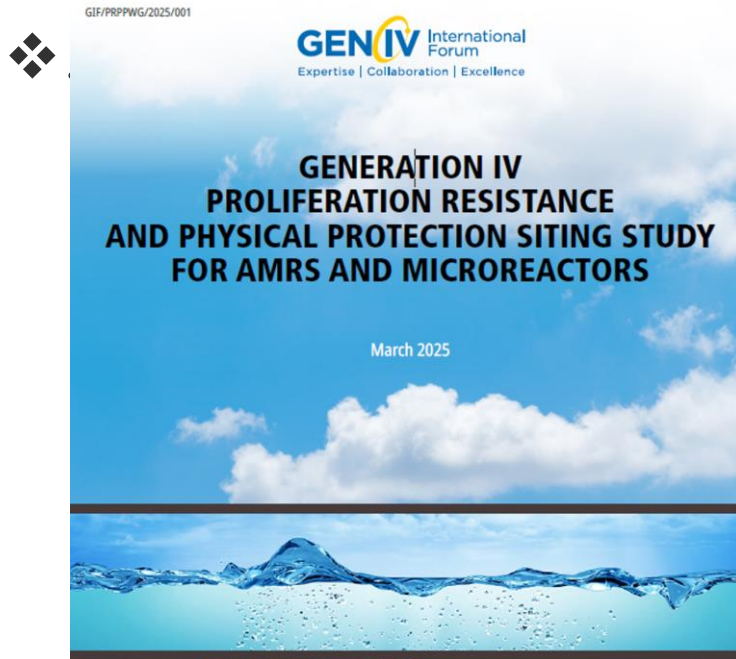
EVT2304537, 18-21 Aug 2025

C. SCHERER, D. BOJJA, S.G. YOON, M. ARDHAMMAR, C. De FRANCIA, J.-S. LEE, J. S. ADAMS, C. BATHKE (Retired), B. BOYER, S. CHIRAYATH, G.G.M. COJAZZI (Retired), B. van der ENDE, G. RENDA⁷



Cooperation with International Organizations

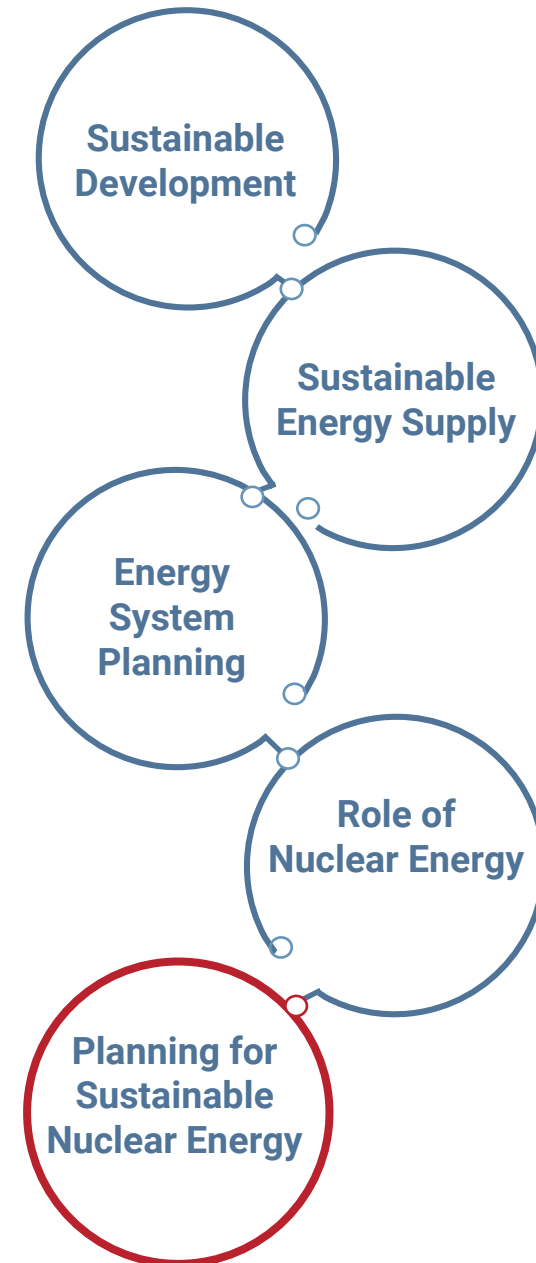
- ❖ Working on GIF PRPPWG - Observer
- ❖ Generation IV International Forum
Case Study of 3S Interfaces for a Very High Temperature Reactor System



International **PRO**ject on Innovative Nuclear Reactors and Fuel Cycles (**INPRO**)

Ensure nuclear energy can contribute, in a sustainable manner, to the energy needs of the current century and beyond

- Support Member States in their long-term planning for deploying sustainable nuclear energy – INPRO methodology
- Provide support for developing advanced and innovative nuclear energy systems:
 - Scenario modelling and analysis,
 - Technical and institutional innovations
 - Sustainability assessments and strategies
 - Education, outreach, dialogue
- Facilitate cooperation and collaboration among Member States in their roles as nuclear energy technology developers, suppliers and customers



Building Capacity in Strategic Planning for Sustainable Nuclear Energy

Target Audience

Experts, analysts, advisors to decision makers

Junior experts, analysts, engineers, managers, graduates, post-graduates, university teachers

Universities and centers of excellence, teachers, post-graduates, and students

INPRO Advisory Service

supporting countries in making informed decisions on nuclear energy development and deployment

National level, upon MS request

INPRO Schools

developing and strengthening competencies

ICTP, National, Regional, International level

Developing competencies

(Collaborative Project - Universities, workshops, schools)

building competencies for long-term nuclear energy planning

National, Regional, International level

Supports Members States to prepare for Milestones Approach – sustainable nuclear energy planning

INPRO Section



C. Scherer
Section Head INPRO



New USA JPO
Louis Dauphin

INPRO Administration



Finance Assistant
S. Crozier



Implementation
Assistant
T.-L. Loi

TASK 1 Global Scenarios



C. Johari
Task Leader



P. Ptitsyn
Russian CFE



Divya Bojja
MSC Intern



Faiza Sohail
MSC Intern



M. Gladyshev
Task Leader



H.S. Cho
RoK CFE

TASK 4 Dialogue and Outreach

TASK 2 Innovations



New Keith Fox
USA CFE



H. Khartabil
Task Leader



JinJue Kim
RoK Intern

Pending

Russ. Intern



M. Khoroshev



M. T. Vu
Task Leader

TASK 3 Sustainability Assessment and Strategies



Thank you!

C.Scherer@IAEA.org